Using Automated Analytics to Optimize Groundwater Monitoring at MNA Sites

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Background/Objectives. After completion of remedial activities, many sites rely on monitored natural attenuation (MNA) to demonstrate continued compliance and provide a line of evidence toward regulatory closure. Because this continued monitoring presents a long-term cost for responsible parties, reducing the number of samples collected each round can substantially reduce the total cost to closure. This presentation will illustrate how R scripting and Microsoft® Power BI were used to efficiently assess monitoring network and sampling program representativeness and track progress toward key performance indicators (KPIs) to optimize large groundwater monitoring programs and MNA performance to achieve closure.

Approach/Activities. To optimize groundwater monitoring programs, Woodard & Curran developed a list of criteria to review for each well currently monitored. These criteria include Mann-Kendall trends, spatial representation, current concentrations of site constituents of concern (COCs), water quality parameter performance, and the extent of degradation. Because the cost-savings of an optimized groundwater monitoring program are greatest at sites with large monitoring well networks, modern technologies for processing and analyzing large data sets greatly enhance the efficiency and accuracy with which the well network can be evaluated.

The R programming language was used to query the site database and organize the data for efficient calculation of monitoring KPIs. In addition to automating the calculation of KPI inputs, R was used to efficiently evaluate the spatial density of the monitoring well network by providing a list of wells with a similar screen depth interval within a specified distance from each monitoring well.

The output from the R script was visualized using a Microsoft® Power BI dashboard to dynamically calculate KPIs and provide a front end for the project team to review the site's MNA/remedy performance. The initial data processing was scripted from the site database; therefore, revised trends are recalculated for immediate review as new field data are collected. In addition to making the data accessible to the project team, a Power BI dashboard was selected for KPI tracking as Power BI's filtering abilities allow for dynamic recalculation of results if the project team wants to evaluate performance over a specific timeframe or focus on a particular area of the site. The use of these modern tools resulted in the strategic reduction of MNA monitoring wells at a state-led Superfund Site.

Results/Lessons Learned. The sites most likely to benefit from an optimized groundwater monitoring program are large, long-term sites with big data sets. Technological innovations make it possible to automate the holistic review of these data sets to defensibly identify reductions in the number and/or frequency of samples collected. Not only can these technologies lead to reduced costs in the field, but these automated approaches eliminate the effort typically needed to update spreadsheet analyses as new data are generated. These tools have been successfully scaled to multiple projects, further increasing return on investment (ROI).